Physical Review Letters 2014 vol.112 N25

Origin of spectral purity and tuning sensitivity in a spin transfer vortex nano-oscillator

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Abstract

We investigate the microwave characteristics of a spin transfer nano-oscillator (STNO) based on coupled vortices as a function of the perpendicular magnetic field H. Interestingly, we find that our vortex-based oscillator is quasi-isochronous independently of H and for a dc current ranging between 18 and 25 mA. It means that the severe nonlinear broadening usually observed in STNOs can be suppressed on a broad range of bias. Still, the generation linewidth displays strong variations on H (from 40 kHz to 1 MHz), while the frequency tunability in current remains almost constant (7MHz/mA). This demonstrates that isochronicity does not necessarily imply a loss of frequency tunability, which is here governed by the current induced Oersted field. It is not sufficient either to achieve the highest spectral purity in the full range of H. We show that the observed linewidth broadenings are due to the excited mode interacting with a lower energy overdamped mode, which occurs at the successive crossings between harmonics of these two modes. These findings open new possibilities for the design of STNOs and the optimization of their performance. © 2014 American Physical Society.

http://dx.doi.org/10.1103/PhysRevLett.112.257201